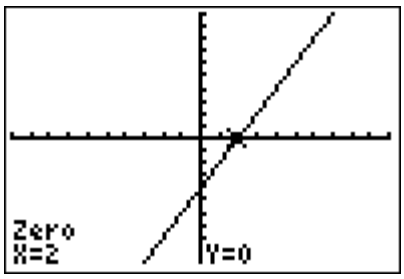
P.5

Solving Equations Graphically, Numerically, Algebraically

Graphically: When solving equations graphically we are trying to find where the graph crosses or touches the x-axis. These places are the x-intercepts where y = 0.

If we have the equation y = 2x – 4 and we want to solve graphically, we will graph this equation and find where the line intercepts the x-axis.

Ex. 

By viewing the graph, we can see x = 2 when y = 0, therefore x = 2 is a solution.

Zero Factor Property

Let *a* and *b* be real numbers. If *ab* = 0, then *a* = 0 or *b* = 0.

Quadratic Equation in x

A **quadratic equation in x** is one that can be written in the form $ax^2+bx+c=0,$ where *a*, *b*, and *c* are real numbers with $a\neq 0$.

Solving Quadratic Equations Algebraically

There are four basic methods to solve quadratic equations algebraically.

1. Factoring
2. Extracting Square Roots
3. Completing the Square
4. Using the Quadratic Formula

Factoring

Ex. Solve $2x^2-3x-2=0$ by factoring.

$$2x^2-3x-2=0$$
$$(2x+1)(x-2)=0$$

Using the zero product property we know that:

$$2x+1=0 \quad or \quad x-2=0$$
$$x=\frac{-1}{2} \qquad\qquad x=2$$

Extracting Square Roots

Ex. Solve $(2x-1)^2=9$ algebraically.

$$(2x-1)^2=9$$

$$2x-1=\pm 3$$
$$2x-1=3 \quad or \quad 2x-1=-3$$
$$2x=4 \qquad\qquad 2x=-2$$
$$x=2 \qquad\qquad x=-1$$

Completing the Square

Solve $x^2+6x-7=0$ by completing the square.

$$x^2+6x=7$$
$$\left(\frac{6}{2}\right)^2=9$$
$$x^2+6x+9=7+9$$
$$(x+3)^2=16$$
$$x+3=\pm 4$$
$$x=1 \quad or \quad x=-7$$

Using the Quadratic Formula

The solutions of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$, are given by the **quadratic formula** $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$.

Ex. Solve $x(x+5)=12$ using the quadratic formula.

We must first simplify the equation and then get it equal to zero.

$x(x+5)=12$

$x^2+5x=12$

$x^2+5x-12=0$

Now we can determine values for *a*, *b*, and *c*. *a* = 1, *b* = 5, *c* = -12 using the formula we get

$$x=\frac{-5\pm\sqrt{(5)^2-4(1)(-12)}}{2(1)}$$

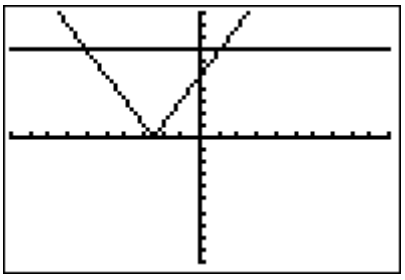
$$=\frac{-5\pm\sqrt{25+48}}{2}$$

$$=\frac{-5\pm\sqrt{73}}{2}.$$

Solving Graphically Using Intersections

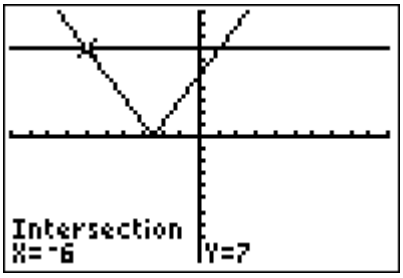
Solve $|2x+5|=7$ graphically by using intersections.

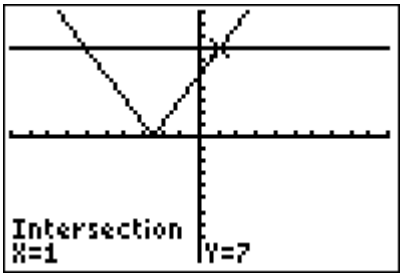
Ex. Graph y = $|2x+5|$ and y = 7 in the same window.



The solutions are the intersections of the lines. There are two intersections therefore there are two solutions.

(Show class how to find intersections on the calc.)





So, the solutions are x = -6 and x = 1.